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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/936,551	12/28/2001	Ian Bennion	P/61761-PCT	7129

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EXAMINER	
KNAUSS, SCOTT A	
ART UNIT	PAPER NUMBER
2874	

DATE MAILED: 10/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/936,551	BENNION ET AL.	
	Examiner	Art Unit	
	Scott A Knauss	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence addr ss --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 August 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *21-27* is/are allowed.

6)☐ Claim(s) *28,29,31-33,36-40 and 42* is/are rejected.

7)☒ Claim(s) *30,34,35 and 41* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. The amendment filed 8/6/03 and the remarks filed therein have been entered and carefully reviewed by the examiner. However, the examiner does not find the remarks to be persuasive, and therefore the rejection is made **FINAL**.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 28,29,31-33,36-40 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,748,312 (Kersey et al.) in view of US 5,451,772 (Narendran).

Regarding claims 28 and 32, Kersey discloses a strain sensing apparatus in fig. 5 comprising:

An optical fiber

A plurality of Bragg grating reflectors (FBG's) spaced lengthwise along the fiber, each reflecting structure having a reflectivity for reflecting light at a different characteristic wavelength ($\lambda 1$ - λN), the wavelength changing in response to the stretching (lengthening) of the reflecting structure (see column 1, lines 22-25, column 9, lines 22-25)

A broadband light source #62 applying light to a fiber, inherently having a wavelength range which covers at least a range of wavelengths over which the reflecting structures reflect

Detector means #50,#68 for determining a change of characteristic wavelength at which the reflecting structures reflect light (see column 9, lines 20-24), the change being indicative of a strain on the grating, which causes a change of spacing (length) of the reflective structure (column 1, lines 22-25)

Kersey does not, however, disclose the use of reflectivities which are different for adjacent reflecting structures.

Narendran, on the other hand, as stated above, discloses the use of a plurality of reflective structures along an optical fiber sensor, and the use of different reflectivities of adjacent reflective structures (see column 4, lines 43-51) to more clearly differentiate discrete responses from the reflective structures.

Therefore it would have been obvious to one of ordinary skill in the art to modify the sensing system of Kersey by varying the reflectivities of each adjacent reflective structure in order to more effectively differentiate between responses from each respective reflective structure.

Regarding claims 29 and 33, the detector means determines the change in wavelength based on light which has been reflected back towards a coupler #48 in fig. 4.

Regarding claim 31 neither Kersey or Narendran disclose the use of the relative magnitude of an intensity of reflective light to discriminate between adjacent reflecting structures.

Nevertheless, since Narendran does, in fact, disclose that the relative intensities of the reflective responses of respective reflective structures can be used to differentiate between the structures (see esp. fig. 9 and accompanying description) and that such a configuration is desirable to discriminate between adjacent structures even more (see column 4, lines 43-51) it would have been obvious to one of ordinary skill in the art to provide a means to discriminate between the respective structures in order to better differentiate the responses from adjacent reflective structures.

Regarding claim 36, fig. 5 of Kersey, as modified by Narendran, does not disclose sweeping the wavelength of light applied to the strain sensor of fig. 5.

Kersey does, however, disclose in fig. 4, #42 and column 8, lines 10-22 using a tunable laser, and tuning the laser wavelength of a tunable laser to each individual

wavelength of respective FBG's, thus "sweeping" the wavelength applied to the strain sensor to analyze the response of each individual FBG sensor.

Thus it would have been obvious to one of ordinary skill in the art to "sweep" the laser wavelength in the sensing system of Kersey, as modified by Narendran, in order to analyze the response of each individual sensor.

Regarding claims 37 and 38, fig. 5 of Kersey, as modified by Narendran, does not disclose securing or placing the fiber gratings sensors (FBG's) in thermal or physical contact with an object to measure strain via a change in length.

Kersey does, however, disclose a possible use for a sensor system in fig. 1A-1C, wherein a fiber #22 is secured to and in thermal contact with a structure #20, such that strain causing a change in physical length of the object causes a change in physical length of the reflecting structure (grating) by stretching the grating (see column 2, lines 1-5). Kersey also discloses that strain in the form of temperature may be also sensed (see column 1, lines 31-37) which would cause strain, and stretch the FBG sensor.

Thus it would have been obvious to one of ordinary skill in the art to use the sensing system of Kersey, as modified by Narendran, to measure changes in temperature and physical length of an object in order to sense the status of a desired object.

Regarding claim 39, as set forth above, Kersey discloses a strain sensor comprising:

An optical fiber having a plurality of reflecting structures (FBG's) spaced lengthwise along the waveguide, each structure having a reflectivity for reflecting light at

a different characteristic wavelength which changes in dependence upon a change in physical length of the respective reflecting structure and detector means #50,#68 for determining a change of characteristic wavelength at which the reflecting structures reflect light (see column 9, lines 20-24), the change being indicative of a strain on the grating, which causes a change of spacing (length) of the reflective structure (column 1, lines 22-25)

Kersey does not, however, disclose the use of reflectivities which are different for adjacent reflecting structures.

Narendran, on the other hand, as stated above, discloses the use of a plurality of reflective structures along an optical fiber sensor, and the use of different reflectivities of adjacent reflective structures (see column 4, lines 43-51) to more clearly differentiate discrete responses from the reflective structures.

Therefore it would have been obvious to one of ordinary skill in the art to modify the sensing system of Kersey by varying the reflectivities of each adjacent reflective structure in order to more effectively differentiate between responses from each respective reflective structure.

Regarding claims 40, the detector means determines the change in wavelength based on light which has been reflected back towards a coupler #48 in fig. 4.

Regarding claim 42, if the sensor of Kersey were modified to use FBG's of differing reflectivities as set forth by Narendran to discriminate between different reflecting structures, it would further have been obvious to one of ordinary skill in the art

to provide a means for measuring the relative differences in reflected magnitude for the purpose of enabling respective reflective structures to be differentiated from each other.

Allowable Subject Matter

5. Claims 21-27, as currently amended, are allowed.

Claims 21-27, as currently amended, include the subject matter previously identified as allowable by the examiner, and are allowed.

Claims 30,34,35 and 41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 30,34,35 and 41, the prior art fails to disclose a method of measuring strain as set forth in claims 28,32 and 33, such that the change in characteristic wavelength is measured by the wavelengths at which the *transmission* of light is attenuated. Claim 35 is dependent from objected to claim 34, and is also objected to.

Response to Arguments

6. The applicant has traversed the examiner's rejection of 28 and 32 over Narendran, arguing that the monochromatic source of Narendran could not be used with the applicant's invention, and that Narendran does not disclose reflecting different frequencies. In response, the examiner has withdrawn the rejection based on Narendran alone. However, the examiner also set forth in the previous office action a rejection based on Kersey in view of Narendran, which is repeated above. Since the applicant's reply did not address these grounds of rejection, they are repeated, and the

action is made final. The examiner submits that it would have been obvious to one of ordinary skill in the art to incorporate the teachings of Narendran into the sensor disclosed by Kersey, thus providing adjacent reflecting structures differing in reflectivity, for the purpose of differentiating adjacent reflective structures. Furthermore, it is well known in the art that the reflectivity of a FBG can be varied, and thus would have been an obvious modification to one of ordinary skill in the art.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott A Knauss whose telephone number is (703) 305-5043. The examiner can normally be reached on 9-6 Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (703) 308 - 4819. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0530.

Scott Knauss Art Unit 2874

sak
October 2, 2003

HEMANG SANGHAVI